

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 9457WO/JS/LA	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/SE 2003/001786	International filing date (<i>day/month/year</i>) 18-11-2003	Priority date (<i>day/month/year</i>) 19-11-2002
International Patent Classification (IPC) or national classification and IPC H01C 7/18		
Applicant ABB AB et al		

1.	This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2.	This REPORT consists of a total of <u> 3 </u> sheets, including this cover sheet.
3.	This report is also accompanied by ANNEXES, comprising: <div style="margin-left: 20px;"> a. <input checked="" type="checkbox"/> (<i>sent to the applicant and to the International Bureau</i>) a total of <u> 3 </u> sheets, as follows: <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. </div> </div> <div style="margin-left: 20px;"> b. <input type="checkbox"/> (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions). </div>
4.	This report contains indications relating to the following items: <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> Box No. I Basis of the report <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input type="checkbox"/> Box No. VIII Certain observations on the international application </div>

Date of submission of the demand 27-04-2004	Date of completion of this report 18-10-2004
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE 2003/001786

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished
- ☒ the description:

pages 1-13 _____ as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

- ☒ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* 1-3 received by this Authority on 11-10-2004
- pages* _____ received by this Authority on _____

- ☒ the drawings:
- pages 1/8-8/8 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____

- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE 2003/001786

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-10</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-10</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-10</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Cited document D: US 424921 A

Document D discloses a resistive heater, comprising a plurality of serially connected resistor elements a,b made of sheets and being mutually separated by disc-shaped insulating shims c.

Amended claim 1 in the International Application differs from what is disclosed in document D in that each of the resistor elements is formed as a ring with an outer and an inner element diameter, that the resistor element is split by a continuous radial slit, and that the first and second terminals are arranged adjacent to the slit on both sides thereof. Thus the resistor defined in claim 1 is novel.

The resistive heater disclosed in document D comprises resistor elements formed as rectangular strips. There is no information whatsoever in document D that would lead a person skilled in the art towards a ring-shaped resistor arrangement. The object of the invention defined in document D is that the heating surface shall be concentrated so as to occupy only a small space. The object of the present invention is to provide a resistor which exhibits a low inductance and permits efficient cooling. The object of the invention thus is different from the object of the cited art. Thus the resistor defined in claim 1 is deemed to fulfil the criterion of inventive step.

The remaining claims 2-10 are all dependent claims, and thus involve novelty and inventive step.

The invention is industrially applicable.

CLAIMS

1. A high-power resistor comprising a plurality of resistor elements (1), made of sheets of an electrically conductive resistance material, each having a first (13) terminal and a second (14) terminal, and each resistor elements being mutually separated by disc-shaped insulating first shims (2), said first terminal of a first resistor element of the plurality of resistor element being connected to said first terminal of an adjacent second resistor element of the plurality of elements, said second terminal of the second resistor element being connected to said second terminal of an adjacent third resistor element of the plurality of resistor elements, thus forming a current path of serially connected resistor elements, **characterized** in that each of the resistor elements is formed as a ring with an outer and an inner element diameter, that the resistor element is split by a continuous radial slit (12), and that said first and second terminals are arranged adjacent to the slit on both sides thereof.

2. A high-power resistor according to claim 1, **characterized** in that each of said first shims (2) has the shape of a ring.

3. A high-power resistor according to claim 2, **characterized** in that said first shims (2) comprise a plurality of radially extending channels (22, 23) so that radially extending flow paths for a cooling medium is formed which, in the plane of the sheets, are limited by two adjacent resistor elements and which, via gaps (O1, O2, O3, O4), communicate with a cylinder-shaped space (SP1), limited in a radial direction by the inner edges of the resistor elements and said first shims, respectively, and with a space (SP2), located in a radial direction outside the outer edges of the resistor elements and the first shims, respectively.

4. A high-power resistor according to claim 3, **characterized** in that each of said first shims substantially has the shape of a circular ring with an inner diameter that is smaller than the inner element diameter and an outer diameter that is larger than the outer element diameter, and said channels consist of slits (22) extending radially from an outer diameter that is larger than the outer element diameter but smaller than the outer diameter of the shim, and an inner diameter that is smaller than the inner element diameter but larger than the inner diameter of the shim.

5. A high-power resistor according to claim 3, **characterized** in that each of said first shims substantially has the shape of a circular ring with a number of radially directed tongues (24), the ring having an inner diameter that is smaller than the inner element diameter and the tongues extending in a radial direction outside the outer element diameter, and that said channels consist of openings (25) that are limited by said tongues in a tangential direction.

6. A high-power resistor according to any of claims 3-5, **characterized** in that it is located in a substantially cylindrical container so that flow paths for the cooling medium are formed in a direction substantially perpendicular to the plane of the sheets both in a cylinder-shaped space (SP1), limited in a radial direction by the inner edges of the resistor elements and said first shims, respectively, and in a space (SP2), limited in a radial direction by the inner wall (CW) of the container and by the outer edges of the resistor elements and said first shims, respectively.

7. A high-power resistor according to claim 6, **characterized** in that it comprises a first blocking means (5, 6) for blocking that flow path for the cooling medium which is constituted by the space (SP2), limited in a radial direction by the inner wall of the container and the outer edges of the resistor elements and said first shims, respectively.

8. A high-power resistor according to claim 7, **characterized** in that said first blocking means comprises a disc-shaped insulating second shim (5, 6) arranged between two adjacent resistor elements and substantially having the shape of a circular ring with an outer diameter that is essentially equal to the diameter of the inner wall (CW) of the container, said ring, in a direction perpendicular to the plane of the sheets, exhibiting a first part (6) with the circular ring split up in the tangential direction and with an inner diameter that is essentially equal to the outer element diameter, and a second part (5) with an inner diameter that is smaller than the inner element diameter, and with a plurality of radial slits (52) extending from an outer diameter that is larger than the outer element diameter and an inner diameter that is smaller than the inner element diameter.

9. A high-power resistor according to any of claims 7-8, **characterized** in that it comprises a second blocking means (3, 4) to block that flow path for the cooling medium which is constituted by the cylinder-shaped space (SP2), which in a radial direction is limited by the inner edges of the resistor elements and said first shims, respectively.

10. A high-power resistor according to claim 9, **characterized** in that said second blocking means comprises a disc-shaped insulating third shim (3, 4), arranged between two adjacent resistor elements, substantially having the shape of a circular disc, which in a direction perpendicular to the plane of the sheets exhibits a first part (4) with a diameter that is essentially equal to the inner element diameter, and a second part (3) with an outer diameter that is smaller than the diameter of the inner wall of the container but larger than the outer element diameter, and with a plurality of radial slits (32) extending from an outer diameter that is larger than the outer element diameter but smaller than the outer diameter of said shim, and an inner diameter that is smaller than the inner element diameter.